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Chemical Weathering Kinetics of Basalt on Venus

NAGW-4485

Final Report

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Abstract. This final report summarizes the significant accomplishments of research at Washington University in St. Louis for NASA Grant NAGW-4484 "Chemical Weathering Kinetics of Basalt on Venus", Professor Bruce Fegley, Jr., PI.

Summary. The purpose of this project was to experimentally measure the kinetics for chemical weathering reactions involving basalt on Venus. The thermochemical reactions being studied are important for the CO₂ atmosphere-lithosphere cycle on Venus and for the atmosphere-surface reactions controlling the oxidation state of the surface of Venus. These reactions include the formation of carbonate and scapolite minerals, and the oxidation of Fe-bearing minerals. These experiments and calculations are important for interpreting results from the Pioneer Venus, Magellan, Galileo flyby, Venera, and Vega missions to Venus, for interpreting results from Earth-based telescopic observations, and for the design of new Discovery class (e.g., VESAT) and New Millennium missions to Venus such as geochemical landers making *in situ* elemental and mineralogical analyses, and orbiters, probes and balloons making spectroscopic observations of the sub-cloud atmosphere of Venus.

Results. The results of this project have all been published in refereed publications. These publications are listed below.

1. B. Fegley, Jr., G. Klingelhöfer, R.A. Brackett, N. Izenberg, D.T. Kremser, and K. Lodders (1995) Basalt Oxidation and Hematite Formation on the Surface of Venus *Icarus* **118**, 373-383.
2. B. Fegley, Jr., M.Yu. Zolotov, and K. Lodders (1996) The Oxidation State of the Lower Atmosphere and Surface of Venus. *Icarus* **125**, 416-439.

3. G. Klingelhöfer, B. Fegley, Jr., R.V. Morris, E. Kankaleit, P. Held, E. Evlanov, and O. Priloutskii (1996) Mineralogical Analysis of Martian Soil and Rock by a Miniaturized Backscattering Mössbauer Spectrometer. *Planet. Space Sci.* **44**, 1277-1288.
4. B. Fegley, Jr., G. Klingelhöfer, K. Lodders, and T. Widemann (1997) Geochemistry of Surface-Atmosphere Interactions on Venus, in *Venus 2*, ed. S.W. Bougher, D.M. Hunten & R. Phillips, Univ. of Arizona Press, in press.
5. B. Fegley, Jr. (1997) Why Pyrite is Unstable on the Surface of Venus. *Icarus* **128**, 474-479.
6. M.Yu. Zolotov, B. Fegley, Jr., and K. Lodders (1997) Hydrous Silicates and Water on Venus. *Icarus*, in press.